

THE RELATIVE CONDITION FACTOR AND LENGTH-WEIGHT RELATIONSHIP OF A FRESHWATER CARP, *LABEO GONIUS* (HAM.) (CYPRINIDAE, TELEOSTEI)¹

ANIL CHATTERJI²
(With five text-figures)

INTRODUCTION

The relative condition factor (Kn) and length-weight relationship of a fish, *Labeo gonius* (Ham.) is reported here. These two factors are generally used for obtaining data on robustness, gonad development, time of spawning and the size at first maturity.

MATERIAL AND METHODS

The material for the present study were obtained from the commercial catch from River Kali at Aligarh from October, 1972 to October, 1973. Specimens ranging from 150-450 mm in length and 27-930 gm in weight were included in the present investigation. The analysis of relative condition factor and length-weight data was done using the methods given by LeCren (1951).

RESULTS

Variations in the values of relative condition factor in relation to size are presented in Figure 1. The value was found to be highest in smaller fishes of both sexes. High values were obtained upto 210 mm in males and

230 mm in females. The values increased and decreased alternately upto the length of 450 mm and three peaks and three valleys were obtained at the lengths of 210 mm, 330 mm and 390 mm in males, while at 310 mm, 370 mm and 430 mm in females (Fig. 1).

The gonado-somatic indices showed seasonal variation in both sexes. It started increasing from March and reached a maximum in May in case of males and June in case of females when the fish possessed fully ripe gonads. The gastro-somatic indices dropped suddenly in July and from July to February, it almost remained constant (Fig. 2).

There was a sharp increase in condition-with gonad from April to June while the condition-minus-gonad in females decreased considerably. The decrease in condition-with gonad during July and August was also very significant whereas, condition-minus-gonad did not show any remarkable decrease. No difference between condition-with-gonad and condition-minus-gonad was observed during rest of the year. A similar trend was noticed for males. Gastro-somatic index was found to decrease significantly from April to July in females. During rest of the months, the values were found to increase gradually in both sexes (Figs. 3 and 4).

Regression analysis on length-weight relationship along with the test of significance have been presented in Table 1 and the analysis of

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² Section of Ichthyology and Fisheries, Department of Zoology, Aligarh Muslim University, Aligarh-202001, India.

TABLE I

STATISTICS OF REGRESSION OF LOG WEIGHT ON LOG LENGTH OF *L. gonius*

Source	Regression coefficient 'n'	S.S. due to regression	Residual S.S.	D.F.	Correlation coefficient	Observed 'T'	5% 't'	S
Male	3.1010	38.3750	3.6945	59	0.0375	2.0997	2.001	S
Female	3.0981	24.3953	3.8283	119	0.2669	1.9951	1.981	S
Juvenile	3.1322	26.3333	3.0166	13	0.5831	2.4861	2.160	S
Maturity stage—								
I Male	3.0030	1.3440	0.1633	18	0.6719	1.7403	1.101	NS
Maturity stage—								
I Female	3.0547	0.6868	0.0334	29	0.0815	0.4399	2.045	NS
Maturity stage—								
II Male	3.1568	0.9215	0.0383	8	0.2018	0.5396	2.306	NS
Maturity stage—								
II Female	3.0677	1.1559	0.0501	20	0.7704	1.5265	2.086	NS
Maturity stage—								
III Male	3.0140	1.1689	0.0627	11	0.0980	0.3408	2.201	NS
Maturity stage—								
III Female	3.3744	1.5398	0.0300	17	0.4400	1.0831	2.110	NS
Maturity stage—								
IV Male	3.6112	0.4898	0.0347	12	0.6441	1.7929	2.179	NS
Maturity stage—								
IV Female	3.6625	0.6592	0.0933	25	0.2608	1.3232	2.060	NS
Maturity stage—								
V Male	3.0734	0.5328	0.0254	5	0.6084	1.5332	2.571	NS
Maturity stage—								
V Female	3.0377	0.5774	0.0380	23	0.0785	0.3691	2.069	NS
Total within different maturity stages	3.0837	16.7605	7.9044	171	—	—	—	—
		DIFFERENCE	0.0307	10	—	—	—	—
Total between means of different maturity stages	3.1780	0.9038	0.0407	9	—	—	—	—
		TOTAL	7.9451	191	—	—	—	—
Combined (Male, Female and Juvenile)	3.7794	17.6643	7.9450	192	0.6316	11.2874	1.960	S
		DIFFERENCE	0.0001	1	—	—	—	—

S.S. = Sum of squares. D.F. = Degrees of freedom NS = Not significant S = Significant.

RELATIVE CONDITION FACTOR OF LABEO GONIUS

TABLE 2
ANALYSIS OF VARIANCE FOR DATA OF TABLE 1

Source	Sums of square	D. F.	Variance
Due to total regression	17.6643	1	17.6643
Between regression coefficient within different maturity stages	0.0307	10	0.0030
Difference between pooled within different maturity stages and means regression	0.0001	1	0.0001
Deviation of means from means regression	0.0407	9	0.0045
Residual	7.9450	171	—
Total	25.6808	192	—

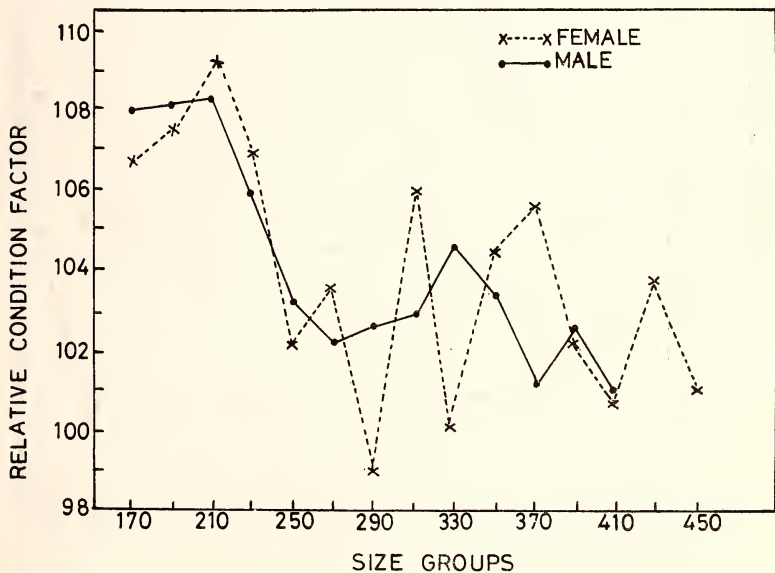


Fig. 1. Mean 'Kn' values at different size groups of *Labeo gonius*.

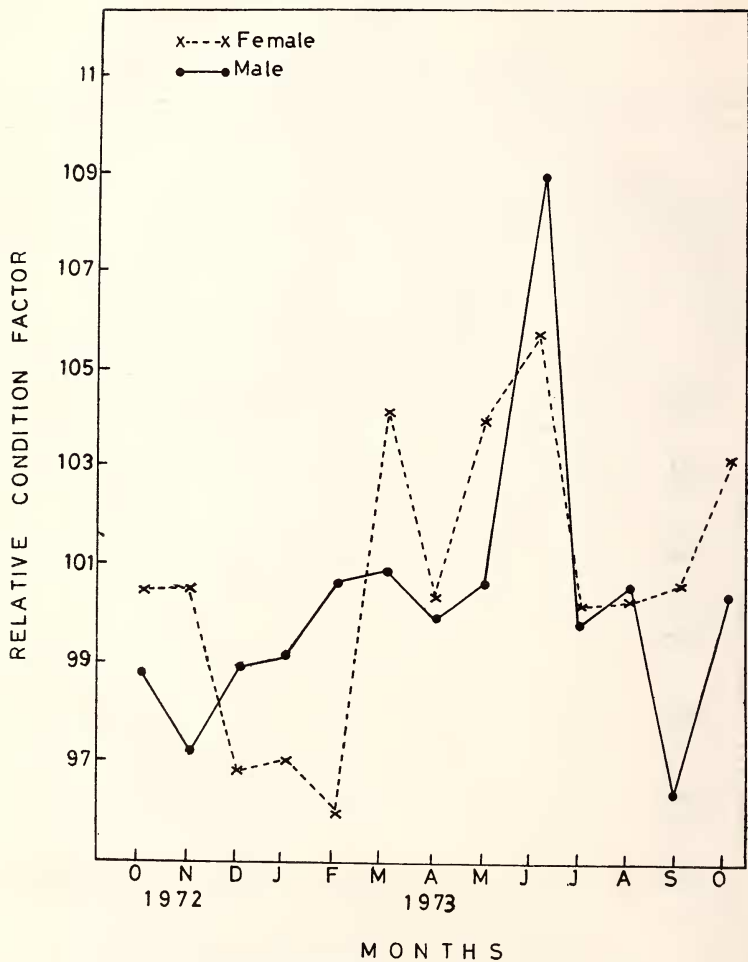


Fig. 2. Monthly variations in mean 'Kn' values of *Labeo gonius*.

RELATIVE CONDITION FACTOR OF LABEO GONIUS

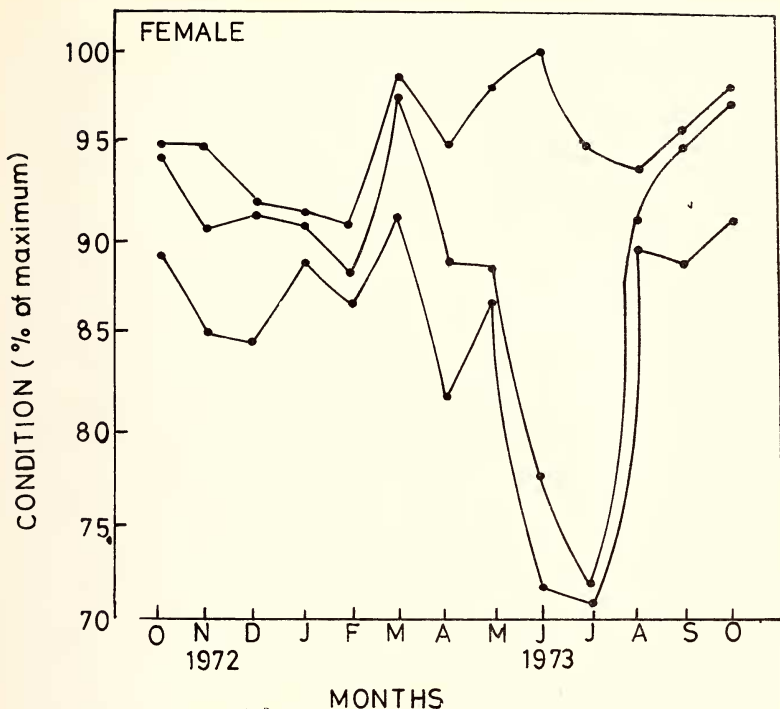


Fig. 3. Seasonal fluctuations in 'condition with gonad', 'condition minus gonad' and 'condition minus gonad plus gut' of *Labeo gonius* (Females).

variance for data in Table 1 is summarised in Table 2. The 'n' values ranged from 2.1995 (guttled females) to 3.0981 (ripe females) and 2.3693 (guttled males) to 3.1010 (ripe males). It was found to be highest in juveniles (3.1322) and lowest in females (3.0981). The

calculation of 'n' values at 95% confidence limits for males, females and juveniles were always higher than 3 (Table 3). The length-weight relationships of males, females and juveniles are plotted in Figure 5a. It is quite clear from this figure that females were lighter

than males upto a length of 245 mm. and heavier beyond it. The length-weight curves of the two sexes intersected at a point between 245-265 mm. Figure 5b shows the smooth curve of the length-weight relationship of combined fishes.

DISCUSSION

The present study showed that the fluctuations in relative condition factor of *Labeo gonius* (Ham.) in relation to size appear to be influenced by the number of spawnings

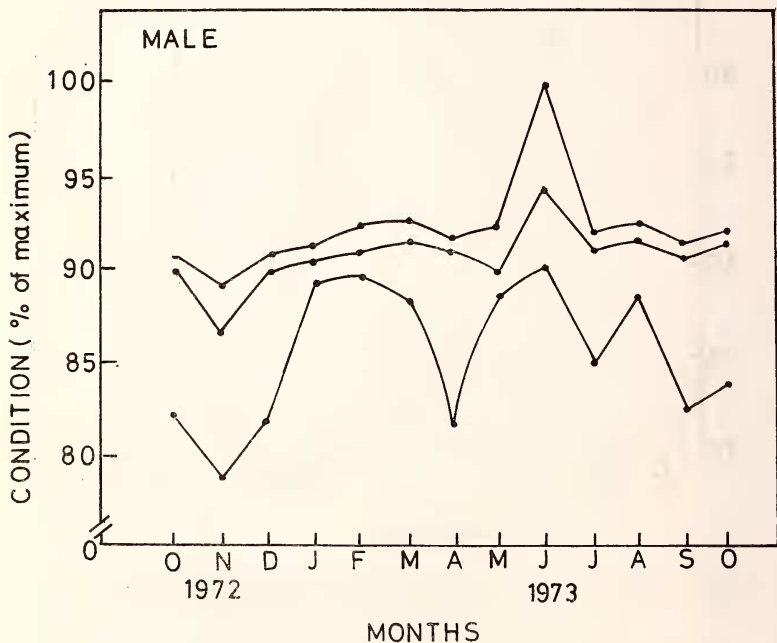


Fig. 4. Seasonal fluctuations in 'condition with gonad', 'condition minus gonad' and 'condition minus gonad plus gut' of *Labeo gonius* (Males).

RELATIVE CONDITION FACTOR OF LABEO GONIUS

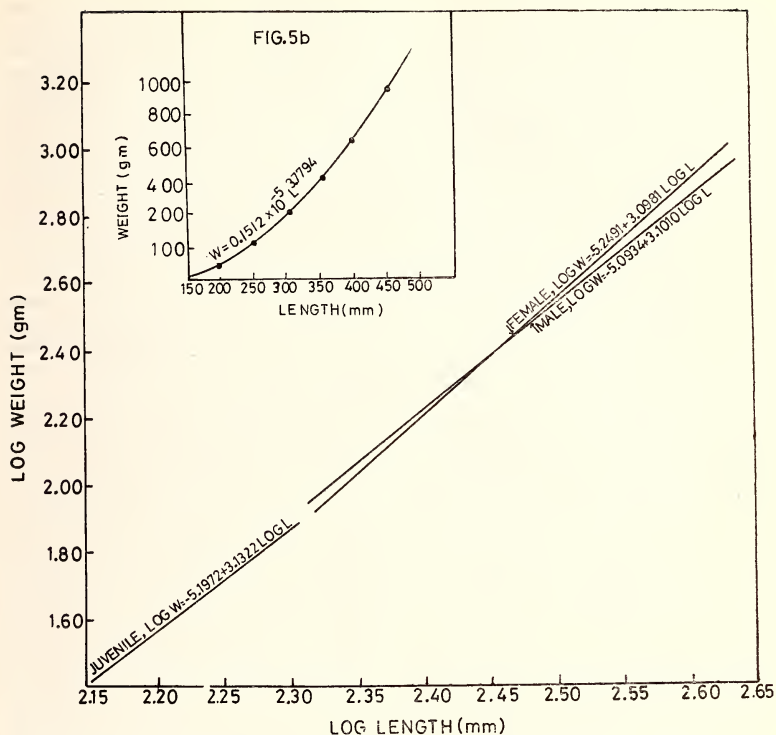


Fig. 5(a) The length-weight relationship of males, females and juveniles of *L. gonius*.
 Fig. 5(b) The length-weight relationship of combined *L. gonius* (smooth curve represents the calculated weight).

that have taken place in six to seven years of life period. In this event the fish appeared to have spawned 3-4 times as the fish attains sexual maturity when it is about two years old. Therefore, the fish successively spawns

each year (Chatterji *et al.* 1976, Siddiqui *et al.* 1976). Seasonal fluctuations in the relative condition factor were mainly due to maturation and depletion of gonads. Highest values were recorded when the fish was in ripe condi-

TABLE 3

REGRESSION EQUATION OF WEIGHT ON LENGTH OF *Labco gonius* AND THEIR TEST OF SIGNIFICANCE

Source	Regression coefficient of 'n'	Intercept of 'n'	Variance of 'n'	S.D. of 'n'	95% confidence limit of 'n'	S.E. of 'n'	Regression equation (Log w = a + n Log l)	Parabolic equation (W = a L ^b)
Male	3.1010	-5.0934	0.0414	2.2034	3.0492-3.1527	0.01738	Log W = -5.0934 + 3.1010 Log L	W = 0.8066 × 10 ⁻⁵ L ^{3.1010}
Female	3.0981	-5.0491	0.0288	0.1697	3.0678-3.1284	0.00654	Log W = -5.0491 + 3.0981 Log L	W = 0.5635 × 10 ⁻⁵ L ^{3.0981}
Juvenile	3.1322	-5.1972	0.0259	0.1611	3.0475-3.2169	0.01336	Log W = -5.1972 + 3.1322 Log L	W = 0.7995 × 10 ⁻⁵ L ^{3.1322}
Combined	3.7794	-6.8205	0.0321	0.1792	3.7541-3.8046	0.00673	Log W = -6.8205 + 3.7794 Log L	W = 0.1512 × 10 ⁻⁵ L ^{3.7794}

tion and lowest just after the spawning. Similar observations have been made in majority of the fish species which are seasonal breeders (LeCren 1951, Pillay 1953, Sarojini 1957, Pantulu 1963 and Chatterji *et al.* 1976). Some evidences are also available showing seasonal fluctuations brought about by feeding rhythm of the fish (Bal and Jones 1960, Blackburn 1960, Qayyum and Qasim 1964, Khan 1972 and Bhatt 1977). An increase in condition-with-gonad from April to June was due to the increased gonad weight and continued decrease in condition-minus-gonad indicated that certain amount of growth potential was sacrificed for gonad building. Since ovary weight increases enormously as compared to testes weight, this sacrifice was more pronounced in females than in the males.

The length-weight relationship of the fish did not follow the cube law as the values of slope 'n' were recorded always higher than 3 in the present case. Therefore, the weight of fishes increased more than the cube of the length. In some other carps a similar trend has been reported (Jhingran 1952, Chakrabarty and Singh 1963, Natarajan and Jhingran 1963, Bhatnagar 1972, Khan 1972, Ramamohana Rao and Hanumantha Rao 1972 and Chatterji *et al.* 1977). In small fishes, the observed weight was recorded lesser than the calculated weight while opposite was true for the larger fishes (Jhingran 1952, Chatterji *et al.* 1977).

In ripe fishes, the values of 'n' were higher whereas, in spent fishes, they were lower. During spawning period, the weight of the gonads increased considerably resulting in an increase in the total weight of the adult fish as well as a higher 'n' value. As soon as the fish discharged their gonad products the weight of the fish decreased resulting in a simultaneous decrease in 'n' value. Such changes in 'n'

values reflect the onset of spawning season of the fish (Chatterji *et al.* 1977). The length-weight curve of males lies above the length-weight curve of females upto the length of 250 mm and beneath the length-weight curve of females afterwards. The point of intersection (between 250-265 mm) seems to represent the size at first maturity of the fish as reported by other workers also (Olsen and Merriman 1946, Natarajan and Jhingran 1963, Khan 1972 and Chatterji *et al.* 1977).

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